Scheme principles for GHG calculation

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Contents

1 Requirements for greenhouse gas saving

According to Directive (EU) 2018/2001 the greenhouse gas emission saving from the biofuels, bioliquids and biomass fuels for the transport sector depends on the date the production line of the last interface becomes operational and is tiered according to the following structure:

- 50% for installations in operation on or before 5 October 2015
- 60% for installations starting operation from 6 October 2015 until 31 December 2020
- 65% for installations starting operation from 1 January 2021
- The greenhouse gas emission saving (GHG emission saving) denotes the percentage of greenhouse gas emissions (GHG emissions) that could be saved by using biofuels/bioliquids/biomass fuels instead of fossil fuels.

An installation is deemed to be in operation if it produces biofuels, bioliquids, or biomass fuels for the first time in accordance with its intended purpose after establishing that it is technically ready for operation. The date the installation became operational does not change if individual technical or structural parts are replaced after initial start-up. The last interface supplying biofuels, bioliquids or biomass fuels provides information the date operations began.

The listed minimum greenhouse gas emission saving must be met for the biofuel/bioliquid/biomass fuel to comply with the REDcert scheme requirements.

2 Scheme principles for the greenhouse gas calculation

2.1 Methodology for greenhouse gas calculation

The total GHG emissions and the GHG emissions saving arising from the use of biofuels, bioliquids and biomass fuels are to be calculated in accordance with Directive (EU) 2018/2001 Article 31 (1) to Article 31 (3), Annex V and Annex VI of Directive (EU) 2018/2001 as well as in accordance with Commission Decision 2010/335/EU of 10 June 2010, Commission Communication 2010/C 160/02, Annex II and the Note on the conducting and verifying of actual calculations of the GHG emission saving. Any updates of these regulations or additional guidance by the European Commission on specific technical aspects regarding the calculation rules will immediately enter into force in the REDcert scheme.

Greenhouse gas emissions from the production and use of transport fuels, biofuels, bioliquids and biomass fuels are to be calculated using the following formula[1]

$$E = e_{ec} + e_{l} + e_{p} + e_{td} + e_{u} - e_{sca} - e_{ccs} - e_{ccr}$$

where

E = total emissions from the use of the biofuels, bioliquids and biomass fuels

e_{ec} = emissions from production of the relevant raw materials, and especially in cultivation and harvesting of the biomass from which the bioliquids are produced. The carbon fixation during cultivation is not included

e_{l} = annualised emissions resulting from carbon-stock changes caused by land-use change

e_{p} = emissions from processing

e_{td} = emissions from transport and distribution

e_{u} = emissions from the use of the biofuel/bioliquid/biomass fuel

e_{sca} = emission saving from soil carbon accumulation via improved agricultural management

e_{ccs} = emission saving from carbon capture and geological storage

e_{ccr} = emission saving from carbon capture and replacement

[1] in accordance with Directive (EU) 2018/2001

Greenhouse gas emissions from biofuels/bioliquids/biomass fuels (E) are expressed in terms of grams of CO_2 equivalent per MJ of biofuel/bioliquid/biomass fuel [gCO_2eq/MJ]. Greenhouse gas emissions from raw materials and intermediate products are expressed in terms of grams of CO_2 equivalent per tonne of dry feedstock and intermediate products [$gCO_2eq/t\ dry$].

Emissions from the manufacture of machinery and equipment are not taken into account. CO_2 Emissions of the fuel in use (e_u) shall be taken to be zero for biofuels, bioliquids and biomass fuels. Emissions of non-CO_2 greenhouse gases (N_2O and CH_4) of the fuel in use shall be included in the e_u factor for bioliquids and biomass fuels (excluding biomethane for transport).

Economic operators make available to the auditor all relevant information about the calculation of actual GHG emissions in advance of the planned audit. All data measured and gathered on site which is relevant for the calculation of actual values must be documented and provided to the auditor for verification.

Information on GHG emissions must include accurate data on all relevant elements of the emission calculation formula (if applicable) according to Directive (EU) 2018/2001, Annex V, Part C, No. 1 and Annex VI, Part B No.1.

The auditor must record and document the greenhouse gas emissions (after allocation) produced at the site inspected and, if necessary, the savings in the audit report or in accompanying documentation to show that the calculation has been thoroughly verified and understood.

If these emissions deviate significantly (≥ 10%) from typical values (in accordance with Annex V, Part A and B and Annex VI, Part A of Directive (EU) 2018/2001), the reasons that explain the deviation should be included in the audit report.

The GHG emission saving of biofuels/bioliquids/biomass fuels is to be determined using one of the following alternatives as stipulated in Directive (EU) 2018/2001:

- using the default values (last interface)
- based on actual values calculated in accordance with the methodology in Directive (EU) 2018/2001 (see requirements below)
- using disaggregated default values
- using a combination of disaggregated and actual values

For every phase in the production and supply chain, the use of (disaggregated) default values and/or all details used to determine the actual values (methodology, measurements, data sources for non-measured values) must be documented.

If actual values are not used, the quantity of GHG emissions should not be transferred between various interfaces in the production chain because it is not possible to know whether this is a default value or an actual value in downstream phases. It is therefore the responsibility of downstream operators to include information about the (disaggregated) default GHG emission values for the final biofuel/bioliquid/biomass fuel when reporting to the member states.

2.2 Calculation using default values

Economic operators can use the default value for the GHG emission saving to provide proof of compliance with the greenhouse gas saving requirement if the production pathway is listed in Annex V, Part A and B and Annex VI, Part A and D of Directive (EU) 2018/2001 and if the GHG emissions resulting from carbon-stock changes caused by land-use change (el value) are less than or equal to "0". Default values are to be taken from Annex V, Part A and B and Annex VI, Part A and D of Directive (EU) 2018/2001 as well as from the RED II Corrigenda of 25. September 2020[2]. The European Commission may update the default values. Any updates immediately enter into force in the REDcert scheme.

If a default value is to be used, it is determined by the last interface. In this case, it is sufficient for the upstream economic operators to simply indicate "use default value" or similar wording to the downstream economic operator.

Default values listed in Annex V, Part A and B and Annex VI, Part A and D can only be applied if the process technology and feedstock used for the production of the biofuel/bioliquid/biomass fuel match their description and scope. If specific technologies are stipulated, the default values can only be used if those technologies were actually used. If necessary, both the process technology and the feedstock used must be specified. Where biomethane is used as compressed biomethane as a transport fuel, a value of 4.6 gCO_2eq/MJ biomethane needs to be added to the default values included in Annex VI.

[2] Corrigendum to Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. Available at https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=uriserv:OJ.L_.2020.311.01.0011.01.ENG

2.3 Calculation using actual values

Actual values can be used at any stage of the chain of custody regardless of whether there is a default value or not. Actual values of emissions can only be determined at the point in the chain of custody where they originate (e.g. actual values of emissions from cultivation (e_{ec}) can only be determined at the origin of the chain of custody). Similarly, economic operators will only be able to use actual values for transport if emissions of all relevant transport steps are taken into account. Actual values of emissions from processing can only be determined if emissions of all processing steps are recorded and transmitted through the chain of custody. Actual values are to be calculated in accordance with the methodology described in Directive (EU) 2018/2001, Part C of Annex V for biofuels and bioliquids and in Part B of Annex VI for biomass fuels.

GHG emissions shall be reported using the following units:

a) g CO_2eq/dry ton for raw materials and intermediate products

b) g CO_2eq/MJ for final biofuels/bioliquids/biomass fuels

The greenhouse gases to be included in the GHG calculation are CO_2, N_2O and CH_4. To calculate the CO_2 equivalence, these gases are weighted as follows in accordance with Directive (EU) 2018/2001 (as of 10/2020):

Greenhouse gas	CO_2 equivalence
CO_2	1
N_2O	298
CH_4	25

If these values change in Directive (EU) 2018/2001, they apply in the REDcert scheme with immediate effect.

All GHG emissions (if applicable) that are linked with the incoming feedstock (upstream emissions from e_{ec}, e_l, e_p and e_{td}) are to be adjusted to the respective intermediate product using the feedstock factor.

The following formula is to be used to determine the feedstock factor in relation to the intermediate product:

$$\text{feedstock factor}_{\text{intermediate product}_a} = \frac{\text{feedstock}_a \left[\text{kg}_{\text{dry}}\right]}{\text{intermediate product}_a \left[\text{kg}_{\text{dry}}\right]}$$

Ratio of kg of dry feedstock required to make 1 kg of dry intermediate product.

In addition to the upstream emissions, the emissions for the recipient that occur at the respective interface are to be included.

Whenever a processing step yields co-products, emissions need to be allocated (see section 3.10 "Allocation of greenhouse gas emissions").

An example is provided below to illustrate how the feedstock factor intermediate product and allocation factor intermediate product are applied to emissions from cultivation (e_{ec}).

$$e_{ec}\ \text{intermediate product}_a \left[\frac{gCO_2eq}{t_{dry}}\right]_{ec} =$$

$$e_{ec}\ \text{feedstock}_a \left[\frac{gCO_2eq}{t_{dry}}\right] \times \text{feedstock factor}_{\text{intermediate product}_a} \times \text{allocation factor}_{\text{intermediate product}_a}$$

The upstream emissions for the processing step from e_{ec}, e_l, e_p and e_{td} as well as the emissions to be included for this interface (if applicable) needs to be converted using the fuel feedstock factor(biofuel/bioliquid/biomass fuel), the fuel allocation factor (biofuel/bioliquid/biomass fuel) and the lower heating value (LHV) into the unit gCO_2eq/MJ of final fuel.

The following formula is to be used to determine the fuel feedstock factor:

$$fuel\ feedstock\ factor_a = \frac{\text{feedstock}_a[MJ]}{\text{fuel}_a[MJ]}$$

Ratio of MJ feedstock required to make 1 MJ of fuel (biofuel/bioliquid/biomass fuel).

Whenever a processing step yields co-products, emissions need to be allocated (see section 3.10 "Allocation of greenhouse gas emissions").

Please note that for the calculation of the fuel feedstock factor, the LHV values per dry tonne need to be applied while for the calculation of the allocation factor LHV values for wet biomass need to be used as this approach was also applied for the calculation of the default values. This subtracts from the LHV of the dry matter, the energy needed to evaporate the water in the wet material.

An example is provided below to illustrate how the fuel feedstock factor and fuel allocation factor are applied to emissions from cultivation (e_{ec}).

$$e_{ec}\text{fuel}_a\left[\frac{gCO_2eq}{MJ_{fuel}}\right]_{ec} =$$

$$\frac{e_{ec}\text{feedstock}_a\left[\frac{gCO_2eq}{t_{dry}}\right]}{\text{lower heating value}_a\left[\frac{MJ_{feedstock}}{t_{feedstock\ dry}}\right]} \times fuel\ feedstock\ factor\ _a \times fuel\ allocation\ factor\ _a$$

For the purpose of this calculation feedstock factors based on plant data have to be applied.

Products with a negative energy content are treated at this point as having zero energy, and no allocation is made. See also Directive (EU) 2018/2001, Annex V, Part C, point 18 and Annex VI, Part B No.18.

Once the last interface has determined the total GHG emissions for all elements (if applicable) of the formula in accordance with Directive (EU) 2018/2001, Annex V, Part C, No. 1 and Annex VI, Part B No.1 in gCO_2eq/MJ of biofuel/bioliquid/biomass fuel, other or subsequent emissions for transport and distribution are to be included, see section 3.5 "Requirements for calculating greenhouse gas emissions from transport and distribution". For information on calculating the greenhouse gas emission saving by the last interface, see section 3.11.

It is not necessary to include inputs in the calculation which have little or no effect on the result, e.g. low quantities of chemicals used in processing[3]. Inputs with little or no effects are those that have a calculated impact of less than 0.5% on the total emissions of the respective production unit.

All information on actual GHG emissions is to be included in the GHG emission calculation for all elements of the formula in accordance with Directive (EU) 2018/2001, Annex V und VI and passed along in the value chain (if applicable). Thus separate reporting of e_{ec}, e_l, e_{sca}, e_p, e_{td}, e_{ccs} und e_{ccr} is necessary if relevant or applicable. This applies also to the elements of the formula which are not included in the default values such as el, e_{sca}, e_{ccr} and e_{ccs}. If information necessary for the greenhouse gas calculation is missing, default values are to be used and this must be clearly evident in the report.

[3] Communication from the Commission on the practical implementation of the EU biofuels and bioliquids sustainability scheme and on counting rules for biofuels (2010/C 160/02)

If emissions are not recorded along the production pathway and the result is that downstream operators can no longer calculate actual emissions consistently, this must be clearly indicated in the delivery documents at the phase where this gap occurred taking into account the accompanying documents.

The values (emission factors, heating values, etc.) published on the European Commission website[4]/ included in the Implementing Act shall be used to calculate the actual GHGs.

However, whenever an item appears in the list, the use of alternative values must be duly justified. If alternative values are used, this must be indicated in the documentation of the calculations in order to facilitate the verification by the auditors.

The GHG emissions from raw material production (e_{ec}) can also be reported using NUTS-2 values[5]. These values are alternatives to the individually calculated values. They are published on the website of the European Commission and are not default values. Consequently, they can only be considered input values to calculate individual values of the downstream interfaces. NUTS-2 values are to be indicated in the unit gCO_2eq/t dry along the entire production chain. They are not, however, suitable for specifying emissions from cultivation in gCO_2eq/MJ of biofuel/bioliquid/biomass fuel.

2.4 Calculation using disaggregated default values

Directive (EU) 2018/2001 also provides disaggregated default values in accordance with Part D and E of Annex V and Part C of Annex VI as well as the RED II Corrigenda of 25. September 2020[6], which relate to part of production and can be used in combination with actual values to calculate the GHG emissions. If the main production took place in a region which is listed in the reports of the member states as a NUTS level 2 region or a region at a more disaggregated NUTS level[7], economic operators can apply these specific data as an

[4] The Commission website: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1 (accessed on 27.04.2021)

[5] An overview table of pre-ILUC Directive NUTS2 cultivation emissions values are accessible at https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1 / (accessed on 18.11.2020)

[6] Corrigendum to Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. Available at https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=uriserv:OJ.L_.2020.311.01.0011.01.ENG (accessed on 27.04.2021)

[7] I Consistent with EUROPEAN COMMISSION: Regulation (EC) 1059/2003 of the European Parliament and of the Council as level 2 regions of the classification of territorial units for statistics (NUTS) or as more disaggregated NUTS levels. Available at: http://ec.europa.eu/eurostat/de/web/nuts/overview (last accessed on 01.04.2020).

II Country reports under EUROPEAN COMMISSION: Energy topics. Available at: https://ec.europa.eu/energy/en/topics/renewable-energy/biofuels/ (last accessed on 01.04.2020).

alternative to disaggregated default values, provided the data has been approved by the European Commission.

It is important to note here that there are no default emission values for the component "land-use changes" (e_l). If disaggregated default values are used for cultivation, GHG emissions from land-use changes always have to be added to them.

Disaggregated default values are to be taken from Annex V and VI of Directive (EU) 2018/2001 and can only be applied if the process technology and feedstock used for the production of the biofuel/bioliquid/biomass fuel match their description and scope. The list of (disaggregated) default values can be updated by the Commission. Any changes made by the European Commission to the (disaggregated) default values immediately enter into force in the REDcert scheme.

The disaggregated default values should only be reported for final biofuels/bioliquids/biomass fuels and they are applicable for certain elements in the supply chain. In the case of biofuels/bioliquids for the elements e_{ec}, e_p and e_{td} and in the case of biomass fuels for the elements cultivation, processing, treatment, transport, compression at the filling station and credit for manure use. If economic operators up to the last interface use the disaggregated default values, they have to declare "Use of disaggregated default value" on their delivery documents. For example "Use of disaggregated default value for e_{ec}" or "Use of disaggregated default value for e_{td}". GHG emission data should only be included on documentation if actual values have been applied.

The (disaggregated) default values in Annex V and VI of Directive (EU) 2018/2001 are to be expressed in gCO_2eq/MJ of biofuel/bioliquid/biomass fuel. The values are based on the background data of the Joint Research Center (JRC).

3 Requirements for calculating GHG emissions based on actual values

3.1 Requirements for calculating greenhouse gas emissions from the production of raw material (e_{ec})

The GHG emissions from raw material production (e_{ec}) include the GHG emissions from cultivating and harvesting raw materials as well as the GHG emissions from the production of chemicals and other inputs used for cultivation. To calculate e_{ec}, the following data is collected on site at a minimum, i.e. the respective values are taken from, e.g. company documents:

- quantity of P_2O_5, K_2O, CaO, mineral and organic N fertilisers as well as crop residues [kg/(ha*yr)] – total quantity used annually (in the year of cultivation)
- quantity of chemicals (e.g. pesticides) [kg/(ha*yr)] – total quantity used annually (in the year of cultivation)
- fuel consumption [l/(ha*yr)] - total quantity of diesel used annually for, e.g. tractors and water pumps per hectare in the year of cultivation
- electricity consumption [kWh/(ha*yr)] – total electricity consumption per hectare in the year of cultivation
- quantity and type of raw materials used [kg/(ha*yr)]
- harvest yield [kg dry harvest yield/(ha*yr)] – quantity of the main/co-product in kg dry per hectare in the year of cultivation. If drying took place, the dry matter content of the dried product must be considered

The method for collecting measured data and the measured data for the calculation of the GHG emissions must be documented so that the calculations are also transparent. Actual values of emissions from cultivation can only be determined if greenhouse gas emissions relevant to the interface are recorded and consistently passed along through the production chain.

It must be kept in mind that the requirements above for calculations and formulas are examples. If other emissions are incurred, they must be recorded and included in the calculation. The data has to be placed in the formula in the right places.

The economic operator responsible calculates the GHG emissions for raw material production (eec) including the GHG emissions from cultivation and harvest of the raw material as well as the GHG emissions from production of chemicals or products used in cultivation by using input data in the following formula:

$$e_{ec}\left[\frac{gCO_2eq}{t_{dry}}\right] = \frac{EM_{fertiliser}\left[\frac{gCO_2eq}{ha \times yr}\right] + EM_{pesticides}\left[\frac{gCO_2eq}{ha \times yr}\right] + EM_{fuel}\left[\frac{gCO_2eq}{ha \times yr}\right] + EM_{electricity}\left[\frac{gCO_2eq}{ha \times yr}\right] + EM_{N_2O}\left[\frac{gCO_2eq}{ha \times yr}\right]}{\text{harvest yield}_{\text{main product dry}}\left[\frac{t_{\text{harvest yield}}}{ha \times yr}\right]}$$

where:

$$EM_{fertiliser}\left[\frac{gCO_2eq}{ha \times yr}\right] = \text{fertiliser}\left[\frac{kg}{ha \times yr}\right] \times \left(EF_{production\ fertiliser}\left[\frac{gCO_2eq}{kg}\right] + EF_{field}\left[\frac{gCO_2eq}{kg}\right]\right)$$

$$EM_{pesticides}\left[\frac{gCO_2eq}{ha \times yr}\right] = pesticides\left[\frac{kg}{ha \times yr}\right] \times EF_{production\ pesticides}\left[\frac{gCO_2eq}{kg}\right]$$

$$EM_{fuel}\left[\frac{gCO_2eq}{ha \times yr}\right] = \text{fuel}\left[\frac{l}{ha \times yr}\right] \times EF_{fuel}\left[\frac{gCO_2eq}{l}\right]$$

$$EM_{electricity}\left[\frac{gCO_2eq}{ha \times yr}\right] = \text{electricity}\left[\frac{kWh}{ha \times yr}\right] \times EF_{electricity}\left[\frac{gCO_2eq}{kWh}\right]$$

$$EM_{N_2O}\left[\frac{gCO_2eq}{ha \times yr}\right] = N_2O\left[\frac{g}{ha \times yr}\right] \times GWP_{N_2O}$$

(EM = emissions, EF= emissions factor, GWP= Global warming potential)

Formula components in detail:

- $EF_{production\ fertiliser}$ – emission factor fertiliser production [$kgCO_2eq/kg$ fertiliser]
- EF_{field} – emission factor of laughing gas (N_2O) [$kgCO_2eq/kg$ N fertiliser]
- $EF_{pesticide\ production}$ – emission factor pesticide production [gCO_2eq/kg of pesticides]
- EF_{fuel}– emission factor fuel in agricultural or forestry machinery [gCO_2eq/l of fuel]
- $EF_{electricity}$ – emission factor electricity (e.g. EU electricity mix) [gCO_2eq/kWh]

The GHG emissions from raw material production are specified in relation to the dry harvest yield or dry main product (gCO_2eq/t dry).

The formula below is to be used to specify the emissions of the dry matter in t:

$$e_{ec}\text{main product}_{dry\ a}\left[\frac{gCO_2eq}{t_{dry}}\right] = \frac{e_{ec}\text{main product}_{wet\ a}\left[\frac{gCO_2eq}{t_{wet}}\right]}{(1 - \text{moisture content})}$$

The moisture content is based on the delivery details. If it is missing or not known, it is based on the maximum value allowed in the supply contract.

The values (emission factors, heating values, etc.) published on the European Commission website shall be used to calculate e_{ec}:

https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1 .

Alternatively a scientific literature source or scientifically recognised database (e.g. Bi-oGrace, ecoinvent database) can be used:

However, whenever an item appears in the list, the use of alternative values must be duly justified. If alternative values are used, this must be indicated in the documentation of the calculations in order to facilitate the verification by the auditors.

For synthetic and organic nitrogen fertilisers as well as crop residues left on the field

N_2O field emissions must be calculated.

An appropriate way to take into account N_2O emissions from soils is the IPCC methodology, including what are described there as both "direct" and "indirect" N_2O emissions[9]. All three IPCC tiers can be used by economic operators. Tier 3 is based on detailed measurement and/or modelling. The BioGrace calculation tool provides details on the calculation of the N_2O emissions from the cultivation of the crop using IPCC Tier 1 (http://www.bi-ograce.net/home). Another way to include these emissions is the Global Nitrous Oxide Calculator (GNOC)[10] developed by the Joint Research Center.

The data has to be placed in the formula accordingly. The source must be cited (in particular, the author, title, magazine, volume, year) for values taken from scientific literature sources or scientifically recognised databases. The values taken from literature sources or databases must be based on scientific and peer-reviewed work – with the precondition that the data used lies within the commonly accepted data range when available

Life cycle greenhouse gas emissions from waste and residues, including straw, husks, corn cobs and nutshells, and residues from processing, including crude glycerine (unrefined glycerine) and bagasse, are set to zero until these materials are collected, regardless of whether they are processed into intermediate products before being converted into the final product[11]. Materials can be classified as waste, residue or a co-product using the European Commission Communication COM(2007) 59 and/or on the basis of the REDcert scheme principles for the production of biomass, biofuels, bioliquids and biomass fuels.

3.2 Requirements for calculating greenhouse gas emissions resulting from land-use change (e_l)

In the case of land-use changes (converted areas) that took place on or after the cut-off date of 1 January 2008 and on which cultivation is permitted, under Article 29 of Directive (EU) 2018/2001, the accumulated GHG emissions resulting from the land-use changes must be calculated and added to the other emission values. The term "land use changes" refers to changes among the six land categories recognised by the IPCC (forest land, grassland, cropland, wetlands, settlements and other land). Cropland and perennial cropland shall be regarded as one land use. Perennial crops are defined as multi-annual crops, the stem of which is usually not annually harvested such as short rotation coppice and oil palm.

[9] See 2006 IPCC guidelines for National Greenhouse Gas Inventories, Volume 4, Chapter 11 (https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/4_Volume4/V4_11_Ch11_N2O&CO2.pdf)

[10] Global Nitrous Oxide Calculator (GNOC) (https://gnoc.jrc.ec.europa.eu/)

[11] According to Annex V, Part C, point 18 and Annex VI, Part B point 18 of Directive (EU) 2018/2001

For all grassland it needs to be established whether the grassland would remain or cease to be grassland in the absence of human intervention. Neither natural highly biodiverse grassland nor non-natural highly biodiverse grassland, may not be used for the production of biofuels, bioliquids an biomass fuels (see "Scheme principles for the production of biomass, bioliquids biofuels and biomass fuels"). The Commission may adopt implementing acts further specifying the criteria by which to determine which grassland are to be covered by natural and non-natural highly biodiverse grassland. Once these implementing acts have been adopted, the defined criteria apply with immediate effect in the REDcert scheme.

The change from grassland to cropland is a land-use change, while a change from one crop (such as maize) to another (such as rapeseed) is not. Cropland includes fallow land (i.e. land set at rest for one or several years before being cultivated again). A change of management activities, tillage practice or manure input practice is also not considered land-use change.

GHG emissions from changes in carbon stocks resulting from land-use change (e_l) are to be calculated in accordance with Directive (EU) 2018/2001 and Commission Decision 2010/335/EU of 10 June 2010.

Annualised GHG emissions from carbon stock changes caused by land-use change (el) are calculated by dividing total emissions equally over 20 years. These emissions are calculated as follows:

$$e_l = (CS_R - CS_A) \times 3.664^{12} \times \frac{1}{20} \times \frac{1}{P} - e_B$$

e_l = annualised greenhouse gas emissions from carbon stock change due to land-use change (measured as mass (grams) of CO_2-equivalent per unit biofuel/bioliquid/biomass fuel energy (megajoules)). Cropland and perennial cropland shall be regarded as one land use;

CS_R = the carbon stock per unit area associated with the reference land-use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). The reference land-use shall be the land-use in January 2008 or 20 years before the raw material was obtained, whichever was the later

[12] The quotient obtained by dividing the molecular weight of CO_2 (44.010 g/mol) by the molecular weight of carbon (12.011 g/mol) is equal to 3.664.

CS_A = the carbon stock per unit area associated with the actual land use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). In cases where the carbon stock accumulates over more than one year, the value attributed to CS_A shall be the estimated stock per unit area after 20 years or when the crop reaches maturity, whichever is earlier.

P = the productivity of the crop (measured as biofuel, bioliquid or biomass fuel energy per unit area per year)

eB = Bonus of 29 gCO_2eq/MJ of biofuel, bioliquids or biomass fuel if the biomass is produced on restored degraded land under the following conditions: If evidence is provided that the land:

(a) was not in use for agriculture or any other activity in January 2008; and

(b) is severely degraded land, including such land that was formerly in agricultural use.

The bonus of 29 gCO_2eq/MJ shall apply for a period of up to 20 years from the date of conversion of the land to agricultural use, provided that a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (b) are ensured.

"Severely degraded land" means land that, for a significant period of time, has either been significantly salinated or presented significantly low organic matter content and has been severely eroded. When el is not zero, the annualised GHG emissions from changes in carbon stocks due to land use must be transferred as the value of el in gCO_2eq/t of dry matter of biomass to the next economic operator. The biomass producer shall therefore use the same formulas as above with productivity of the crop (P) expressed in t of dry matter content of the biomass per ha and per year for the calculation.

The Commission shall review, by 31 December 2020, guidelines for the calculation of land carbon stocks drawing on the 2006 IPCC Guidelines for National Greenhouse Gas Inventories – volume 4 and in accordance with Regulation (EU) No 525/2013 and Regulation (EU) 2018/841 of the European Parliament and of the Council. The Commission guidelines shall serve as the basis for the calculation of land carbon stocks for the purposes of Directive (EU) 2018/2001. The criteria defined in the guideline apply with immediate effect in the REDcert scheme.

If evidence is provided that the cropland was categorised as "cropland" before 1 January 2008 and no changes in land use occurred after the cut-off date of 1 January 2008, el equals "0".

3.3 Requirements for the use of aggregate and measured values for agricultural management

Either measured or aggregate values may be used for agricultural management (e_{ec} and e_l). The following must be kept in mind when using aggregated values:

- Aggregate GHG values may be calculated for farmers operating as a group in a certain region, and on the condition that this takes place on a more fine-grained than a NUTS 2 or equivalent level.
- The calculation of aggregate values for cultivation shall follow the methodology for e_{ec} as described in section 3.1 "Requirements for calculating greenhouse gas emissions from the production of raw material (e_{ec})".
- Input data should primarily be based on official statistical data from government bodies if available and of good quality. If not available, statistical data published by independent bodies may be used. As a third option, the numbers may be based on scientifically peer-reviewed work, with the precondition that data used lies within the commonly accepted data range when available.
- The data used shall be based on the most recent available data from the above-mentioned sources. Typically, the data should be updated over time, unless there is no significant variability of the data over time.
- For fertiliser use, the typical type and quantity of fertiliser used for the crop in the region concerned shall be used.
- If a measured value for yields is used (as opposed to an aggregated value) for the calculations, it is required to also use a measured value for fertiliser input and vice versa.

Economic operators must specify the methods and sources used to determine the input data (e.g. average values based on representative yields, fertiliser input, N_2O emissions and changes in the carbon stock).

3.4 Requirements for the calculation of emissions savings from soil carbon accumulation via improved agricultural management (e_{sca})

Improved agricultural management practices, such as the following:

- shifting to reduced or zero-tillage
- improved crop rotations and/or cover crops, including crop residue management
- use of natural soil improver (e.g. compost, manure digestion residues) use of biocoal

can contribute to emission savings from soil carbon accumulation.

Emissions savings from these kinds of improvements can be taken into account if reliable and verifiable evidence is provided that more carbon has been sequestered in the soil or if it can reasonably be assumed that this was the case during the period when the raw materials in question were cultivated. At the same time, it is necessary to take into account the emissions resulting from the increased use of fertilisers and plant protection products associated with these practices.

Measurements of soil carbon can constitute such evidence, e.g. by a first measurement in advance of the cultivation and subsequent ones at regular intervals several years apart.

In such a case, before the second measurement is available, increase in soil carbon would be estimated using a relevant scientific basis. From the second measurement onwards, the measurements would constitute the basis for determining the existence of an increase in soil carbon and its magnitude.

Similarly, the use of manure as a substrate for the production of biogas and biomethane is regarded as improved agricultural manure management, which contributes to emission reduction by preventing diffuse field emissions and can therefore be counted towards esca in accordance with Directive (EU) 2018/2001, Annex VI, Part B, No. 1 with a credit of 45 gCO_2eq/MJ manure or 54 kg CO_2eq/t of fresh matter.

The emission savings in terms of gCO_2eq/MJ can be calculated by using a formula as indicated in point 7 of Annex V an VI in Directive (EU) 2018/2001, replacing the divisor "20" by the period (in years) of cultivation (rotation cycle) of the crops concerned.

Emission savings from soil carbon accumulation through improved agricultural management (esca) shall be calculated according to the following formula:

$$e_{sca} = (CS_R - CS_A) \times 3.664 \times \frac{1}{20} \times \frac{1}{P} - e_B$$[13]

CS_R = the carbon stock per unit area associated with the reference land-use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). The reference land-use shall be the land-use in January 2008 or 20 years before the raw material was obtained, whichever was the later

CS_A = the carbon stock per unit area associated with the actual land use (measured as mass (tonnes) of carbon per unit area, including both soil and vegetation). In cases where the carbon stock accumulates over more than one year, the value attributed to CS_A shall be the estimated stock per unit area after 20 years or when the crop reaches maturity, whichever is earlier.

P = the productivity of the crop (measured as biofuel, bioliquid or biomass fuel energy per unit area per year)

e_B = bonus of 29 gCO_2eq/MJ of biofuel, bioliquids or biomass fuel if the biomass is produced on restored degraded land under the following conditions: If evidence is provided that the land:

(a) was not in use for agriculture or any other activity in January 2008; and

(b) is severely degraded land, including such land that was formerly in agricultural use.

The bonus of 29 g CO_2eq/MJ shall apply for a period of up to 20 years from the date of conversion of the land to agricultural use, provided that a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (b) are ensured.

"Severely degraded land" means land that, for a significant period of time, has either been significantly salinated or presented significantly low organic matter content and has been severely eroded.

[13] The quotient obtained by dividing the molecular weight of CO_2 (44.010 g/mol) by the molecular weight of carbon (12.011 g/mol) is equal to 3.664.

Emission savings from esca are only applicable if the measure for agricultural improvement was undertaken after January 2008.

3.5 Requirements for calculating greenhouse gas emissions from transport and distribution (e_{td})

Emissions from transport and distribution (e_{td}) include emissions from the transport of raw materials and semi-finished products and from the storage and distribution of finished products. All emissions produced by the market supplier (e.g. the filling station) are also taken into account in this formula. Economic operators along the biofuel/bioliquid/biomass fuels supply chain that receive biomass calculate the GHG emissions from transport using the following formula:

$$e_{td}^{'}\left[\frac{gCO_2eq}{t_{dry}}\right] = \frac{(d_{loaded}[km] \times K_{loaded}\left[\frac{l}{km}\right] + d_{empty}\ [km] \times K_{empty}\left[\frac{l}{km}\right] \times EF_{fuel}\left[\frac{gCO_2eq}{l}\right]}{m_{\ transport\ dry}\ [t]}$$

specified in mass units in relation to dry matter content of the transported biomass (gCO_2eq/t dry). This formula applies analogously to all transport options and the energy consumed for them.

In addition to the means of transport used (e.g. 40-tonne diesel truck), the following data must also be available:

- d_{loaded} [km] – transport distance across which the biomass/biofuel/bioliquid/biomass fuel was transported
- d_{empty} [km] – transport distance when the transport vehicle was empty (if the transport vehicle is not empty upon return, it does not have to be included)
- $m_{transport}$ dry [t dry] – measured mass of the transported biomass/biofuel/bioliquid/biomass fuel
- EF_{fuel} [gCO_2eq/l] – emission factor fuel
- K_{loaded} [l/km] – fuel consumption of the means of transport used per km when loaded
- K_{empty} [l/km] – fuel consumption of the transport vehicle used per km when empty

It must be kept in mind that this formula only applies for a single transport step. If there are more transport steps, the corresponding emissions must be calculated individually. Actual transport emissions can only be determined if the information for the transport steps is recorded and consistently passed along through the production chain. If not, the actual value cannot be accepted. The GHG emissions already included for production and cultivation do not have to be included again in the calculation. Other emissions from transport and distribution have to be added to e_{td}.

The values (emission factors, fuel consumption, etc.) published on the European Commission website[14] shall be used to calculate e_{td}.

Alternatively a scientific literature source or scientifically recognised database (e.g. BioGrace, ecoinvent database) can be used.

However, whenever an item appears in the list, the use of alternative values must be duly justified. If alternative values are used, this must be indicated in the documentation of the calculations in order to facilitate the verification by the auditors.

If upstream transport is calculated, the actual GHG emissions must be divided by the amount of dry matter content of the transported biomass. Conversion plants calculate upstream transport emissions in gCO_2eq/t of dry matter content of the transported biomass. The upstream transport emissions therefore have to be adapted by applying a feedstock factor and an allocation factor to provide the GHG emissions for the product to the recipient (see section 2.3 "Calculation using actual values").

The last interface is responsible for calculating the emissions from transport and distribution of the final product.

The GHG emissions related to the storage of biofuels bioliquids and biomass fuels as well as the emissions produced by filling stations also have to be included. These GHG emissions are based on use for electricity production. It is possible that several depots need to be included individually in the calculation for imported biofuels. For the calculation of the emissions produced by filling stations and depots, the values published by JRC[15] (**storage: 0.00084 MJ/MJ fuel**, **filling station: 0.0034 MJ/MJ fuel**) can be applied. Please note

[14] European Commission website (https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1)

[15] Edwards, R., O'Connell, A., Padella, M., Giuntoli, J., Koeble, R., Bulgheroni, C., Marelli, L., Lonza, L., Definition of input data to assess GHG default emissions from biofuels in EU legislation, Version 1d -2019, EUR 28349 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-02907-6, doi:10.2760/69179, JRC115952 (https://op.europa.eu/de/publication-detail/-/publication/7d6dd4ba-720a-11e9-9f05-01aa75ed71a1/language-en) (last accessed on 15.06.2021).

that these values need to be multiplied with the latest EU electricity grid factor to get the final emissions of the storage or the filling station (e.g. Storage emissions= 0.00084 MJ/MJ fuel x $EF_{electicity}$. These values are applicable for all biofuels (e.g. FAME, Ethanol). The values, however, are not applicable for biomethane for transport sector because they do not include the compression at the filling station.

3.6 Requirements for calculating greenhouse gas emissions from the use of biofuels/bioliquids/biomass fuels (e_u)

CO_2 emissions of the fuel in use (e_u) shall be taken to be zero for biofuels, bioliquids and biomass fuels. Emissions of non-CO_2 greenhouse gases (N_2O and CH_4) of the fuel in use shall be included in the e_u factor for bioliquids and biomass fuels (excluding biomethane for transport sector). For biofuels and biomethane for transport, it is therefore not necessary to calculate emissions of the fuel in use (e_u). However, the calculation of non-CO_2 emissions from liquid biofuels is necessary and must be carried out in the form of a GHG emission savings calculation by the last interface (see section 3.11 "Calculating the greenhouse gas emission saving by the last interface").

3.7 Requirements for calculating greenhouse gas emissions from processing (e_p)

Emissions from processing (e_p) include emissions from the processing itself, from waste and leakage and from the production of chemicals or other products used for processing, including CO_2 emissions equivalent to the carbon content of fossil inputs regardless of whether they are actually combusted in the process. The following formula, which only applies for a single processing step, applies:

$$\frac{EM_{electricity}\left[\frac{gCO_2eq}{yr}\right] + EM_{heat}\left[\frac{gCO_2eq}{yr}\right] + EM_{inputs\ production}\left[\frac{gCO_2eq}{yr}\right] + EM_{wastewater}\left[\frac{gCO_2eq}{yr}\right]}{Yield_{main\ product\ dry}\left[\frac{t_{main\ product\ dry}}{yr}\right]}$$

specified in mass units in relation to the dry matter content of the main product (gCO_2eq/t dry).

$$EM_{electricity}\left[\frac{gCO_2eq}{yr}\right] = \text{electricity consumption}\left[\frac{kWh}{yr}\right] \times EF_{electricity}\left[\frac{gCO_2eq}{kWh}\right]$$

$$EM_{heat}\left[\frac{gCO_2eq}{yr}\right] = \text{fuel consumption}\left[\frac{kg}{yr}\right] \times EF_{fuel}\left[\frac{gCO_2eq}{kg}\right]$$

$$EM_{inputs\ production}\left[\frac{gCO_2eq}{yr}\right] = \text{inputs production}\left[\frac{kg}{yr}\right] \times EF_{inputs\ production\ n}\left[\frac{gCO_2eq}{kg}\right]$$

$$EM_{wastewater}\left[\frac{gCO_2eq}{yr}\right] = \text{wastewater}\left[\frac{l}{yr}\right] \times EF_{wastewater}\left[\frac{gCO_2eq}{l}\right]$$

$$Yield_{main\ product\ dry}\left[\frac{t_{main\ product\ dry}}{yr}\right] = \text{annual yield of the main product in t dry matter}$$

(EM= emissions [17]; EF= emission factor)

The annual yield of the main product relates to the dry matter content.

The formula below is to be used to specify the emissions of the dry matter in t:

$$e_p\text{main product}_{dry\ a}\left[\frac{gCO_2eq}{t_{dry}}\right] = \frac{e_p\text{main product}_{wet\ a}\left[\frac{gCO_2eq}{t_{wet}}\right]}{(1 - \text{moisture content})}$$

To calculate the GHG emissions from processing (e_p), the following data at a minimum must be collected on site, i.e. the respective values are taken from, e.g. company documents:

- electricity consumption [kWh/yr] – total electricity consumption per year
- heat generation – type of fuel/combustible used to produce steam (e.g. heating oil, gas, agricultural crop residues)
- fuel consumption [kg/yr] – total annual consumption of fuel for heat generation, (e.g. heating oil [kg], gas [kg], bagasse [kg])
- inputs production [kg/yr] – quantity of chemicals or additional products (inputs) used in processing
- wastewater quantity [l/yr] – quantity of wastewater per year
- yield main product [kg dry/yr] – annual harvest of the main product

[17] The term "EM"= emissions refers to the total emissions and not only to the emissions of the main product.

Input data for calculating emissions from processing steps in the production chain must be measured or based on technical specifications of the processing facility. If the range of emissions for a group of processing facilities (which the respective facility belongs to) is known, the most conservative emission value (highest) for this group is to be used. Actual values of emissions for processing can only be determined if all of the information about emissions relevant to the interface is recorded and consistently passed along through the production chain. Other emissions from processing have to be added to ep. Biodiesel derived by transesterification of fats with methanol (FAME) are regarded in the Renewable Energy Directive as being 100% of renewable origin. Similar to other inputs, the carbon footprint of the methanol used in the esterification process needs to be taken into account in the calculation of the GHG emission intensity of the biofuel. This approach has been used in the calculation of the default values.

The values (emission factors, heating values, etc.) published on the European Commission website shall be used to calculate e_p: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1

Alternatively a scientific literature source or scientifically recognised database (e.g. BioGrace, ecoinvent database) can be used. However, whenever an item appears in the list, the use of alternative values must be duly justified. If alternative values are used, this must be indicated in the documentation of the calculations in order to facilitate the verification by the auditors.

The source must be cited for values taken from scientific literature sources or scientifically recognised databases. If there are different values from producers, the most conservative value is to be used. It is also important to include the emissions arising from chemicals and energy that are also indirectly linked to the production of biofuels/bioliquids/biomass fuels.

In accounting for the consumption of electricity not produced within the biofuel plant, the GHG emission intensity of the production and distribution of that electricity is to be assumed to be equal to the average emission intensity of the production and distribution of electricity in a defined region:

- Where the EU is the defined region, the average EU emission intensity is the assumed reference level.
- In the case of third countries, where grids are often less linked-up across borders, the national average could be the appropriate choice.

In the case of electricity or heat produced locally, individual emission values may be used where appropriate. The prerequisite for this is that the installation in question is not

connected to the electricity or heat grid and that the quantity used for own electricity or heat can be validated using a suitable meter. If this is a quantity of renewable energy produced, for example, by a wind turbine or a biogas plant, the emission factor for electricity or heat can be set to 0. Guarantees of origin for electricity from renewable energy sources or other certificates are not applicable to reduce greenhouse gas emissions.

3.8 Requirements for calculating the emission saving from carbon dioxide capture and replacement (e_{ccr})

The definition of this emissions saving in accordance with Annex V Part C No. 15 and Annex VI Part C No. 15 of the Directive (EU) 2018/2001 is:

"Emission savings from CO_2 capture and replacement, e_{ccr}, shall be related directly to the production of biomass fuel they are attributed to, and shall be limited to emissions avoided through the capture of CO_2 of which the carbon originates from biomass and which is used to replace fossil-derived CO_2 in production of commercial products and services."

To be able to claim these emission savings, the following proof must be provided:

- The purpose for which the captured CO_2 is used.
- The origin of the CO_2 that is replaced.
- The origin of the CO_2 that is captured.
- Information on emissions due to capturing and processing of CO_2.

To supply evidence regarding the origin of the CO_2 that is replaced, operators using the captured CO_2 should state how the CO_2 that is replaced was previously generated and declare, in writing, that due to the replacement emissions of that quantity are avoided.

The evidence must enable auditors to verify whether the requirements of Directive (EU) 2018/2001 are met including that emissions are actually avoided.

To verify that the capturing of CO_2 is used in commercial products and services to replace fossil-derived CO_2, it would suffice to check that the CO_2 was sold to an economic operator that can be expected to have an economical meaningful use for the CO_2.

In this case, there is no need for the certifying company to provide evidence of the actual (end) use of the biogenic CO_2 to replace fossil-derived CO_2 on a case-by-case basis. However, verifiable objective evidence on the CO_2 quantities produced from biogenic carbon in defined time periods must be kept, whereby only those quantities can be credited that are

actually sold on the market as directly commercially usable CO_2 or those that are used directly.

The following parameters are to be considered when calculating the emission saving (e_{ccr}):

- produced quantity of biofuels, bioliquids or biomass fuels
- produced quantity of biogenic CO_2

The following are also to be determined in relation to the processing of CO_2 (e.g. separation and compression of CO_2):

- consumed quantity of energy (electricity, heat, etc.)
- consumed quantity of auxiliary materials
- other process-specific, energy-related input variables

This data, as well as further information on the greenhouse gas intensity of the substances/energies used, is required to calculate the emission savings using the formula element e_{ccr}.

The emissions saving e_{ccr}, specified in the unit g CO_2eq/MJ of fuel (biofuel/bioliquid/biomass fuel), is calculated as follows:

$$e_{ccr}\left[\frac{gCO_2eq}{MJ_{fuel}}\right] =$$

$$\frac{\text{produced quantity of } CO_2 \text{ [t]} - \text{energy used [MWh]} \times \text{EF } \left[t\frac{CO_2eq}{MWh}\right] - \text{auxiliary materials used [t]} \times \text{EF } \left[t\frac{CO_2eq}{t}\right]}{\text{produced quantity of fuel [t]} \times \text{lower heating value fuel } \left[\frac{GJ}{t}\right]}$$

The balancing period of the emission saving (e_{ccr}) must be linked to the greenhouse gas balancing period of the respective production pathway of the fuel.

If the CO_2 is not captured continuously, it may be appropriate to attribute different quantities of savings to biofuels, bioliquids or biomass fuels obtained from the same process.

However, higher savings of CO_2 should never be allocated to a given batch of biofuels, bioliquids or biomass fuels per MJ than the savings from the average quantities of CO_2 in a hypothetical process which captures the total CO_2 from the process.

For example, it would not be justified to allocate different quantities of savings to different biofuels, bioliquids and biomass fuels obtained from the same process. All biofuels, bioliquids or biomass fuels originating from the process are treated equally in this respect.

All emissions and information related to CO_2 capture and savings must be included in the greenhouse gas calculation and documentation.

3.9 Requirements for calculating the emission savings from carbon dioxide capture and geological storage (e_{ccs})

Emission saving from carbon capture and geological storage e_{ccs}, that has not already been accounted for in ep are limited to emissions prevented by the capture and sequestration of CO_2 emissions directly linked to the extraction, transport, processing and distribution of fuel.

The following parameters are to be considered when calculating the emission saving (e_{ccs}):

- produced quantity of biofuels, bioliquids or biomass fuels
- produced quantity of biogenic CO_2

The following are also to be determined in relation to the processing of CO_2 (e.g. separation and compression of CO_2):

- consumed quantity of energy (electricity, heat, etc.)
- consumed quantity of auxiliary materials
- other process-specific, energy-related input variables

This data, as well as further information on the greenhouse gas intensity of the substances/energies used, is required to calculate the emission savings using the formula element e_{ccs}.

The emissions saving e_{ccs}, specified in the unit CO_2eq/MJ of fuel (biofuel/bioliquid/biomass fuel), is calculated as follows:

$$e_{ccs}\left[\frac{gCO_2eq}{MJ_{fuel}}\right] =$$

$$\frac{\text{produced quantity of } CO_2\ [t] - \text{energy used [MWh]} \times \text{EF}\left[t\frac{CO_2eq}{MWh}\right] - \text{auxiliary materials used [t]} \times \text{EF}\left[t\frac{CO_2eq}{t}\right]}{\text{produced quantity of fuel [t]} \times \text{lower heating value fuel}\left[\frac{GJ}{t}\right]}$$

Emission savings from carbon capture and geological storage (e_{ccs}) not already included in ep is limited to emissions prevented by the capture and storage of emitted CO_2 directly associated with the production, transport, processing and distribution of biofuel/bioliquid/biomass fuel, provided that storage complies with Directive 2009/31/EC[18] on the geological storage of carbon dioxide. The balancing period of the emission saving (e_{ccs}) must be linked to the greenhouse gas balancing period of the respective production pathway of the fuel (biofuels, bioliquids or biomass fuels). If the CO_2 is not continuously captured, see section 3.8 "Requirements for calculating the emission saving from carbon dioxide capture and replacement (e_{ccr})".

3.10 Allocation of the greenhouse gas emissions

If other products ("co-products") are produced during a fuel production process in addition to the fuel, the total greenhouse gas emissions from the process are allocated between the biofuel/bioliquid/biomass fuel or intermediate product and the co-products according to their energy content (lower heating value). The portion of GHG emissions allocated to the respective elements of the formula according to Directive (EU) 2018/2001, Annex V, Part C, No. 1 and Annex VI, Part B, No. 1 is to be calculated using the following formula (if applicable):

$$e'_{allocated} = \text{Total GHG emissions} \times \text{allocation factor}$$

The variable total GHG emissions in the formula above is the sum of all GHG gas emissions that are produced up to and including the process step in which the co-product is produced. The allocation involves the formula elements $e_{ec} + e_l + e_{sca}$ + the shares of e_p, e_{td}, e_{ccs} and e_{ccr} up to and including the process step where a co-product is produced. If GHG emissions were already allocated to co-products in an earlier process step, the portion of these greenhouse gas emissions that was assigned to the respective intermediate product in the last process step is used for the total (total GHG emissions).

Heat and electricity are generally excluded from allocation. The defined lower heating values (LHV) of both forms of energy (1 kWh/kWh) mathematically exclude an allocation based on the LHV. The greenhouse gas intensity of excess useful heat and electricity corresponds to the greenhouse gas intensity of the heat or electricity supplied for a fuel production process. It is determined by calculating the greenhouse gas intensity of all inputs to the cogeneration, conventional (i.e. boiler) or other installation supplying heat or

[18] Directive 2009/31/EC (https://eur-lex.europa.eu/legal-content/DE/TXT/?uri=CELEX%3A32009L0031)

electricity for a fuel production process and the emissions from that installation, including raw materials and CH_4 and N_2O emissions. The detailed calculation method to calculate the greenhouse gas intensity of excess useful heat and electricity is described in section 3.11 "Calculating the greenhouse gas emission saving by the last interface".

To calculate the allocation factor for intermediate products and fuels (biofuels/bioliquids/biomass fuels), the following data is collected at a minimum on site, i.e. the respective values are taken from, e.g. company documents:

- mass of intermediate product or fuel [kg dry]
- mass of the co-product [kg dry]

The formula for calculating the allocation factor for the intermediate product is as follows:

$$Allocation\ factor_{\text{intermediate product}_a} = \left[\frac{energy\ content_{\text{intermediate product}_a}}{energy\ content_{\text{intermediate product}_a} + energy\ content_{\text{co-product}_a}}\right]$$

The formula for calculating the allocation factor for fuels is as follows:

$$Fuel\ allocation\ factor\ _a = \left[\frac{energy\ content_{\text{fuel}_a}}{energy\ content_{fuel_a} + energy\ content_{\text{co-product}_a}}\right]$$

where:

$$\text{Energy content}_{\text{fuel}}[\text{MJ}] = \text{yield}_{\text{fuel}}\left[\text{kg}_{dry}\right] \times \text{lower heating value}_{fuel}\left[\frac{\text{MJ}}{\text{kg}_{dry}}\right]$$

$$\text{Energy content}_{co\text{-}product}[\text{MJ}] = \text{yield}_{co\text{-}product}[kg] \times \text{lower heating value}_{co\text{-}product}\left[\frac{\text{MJ}}{kg}\right]$$

The energy content is determined using the LHV and the yield. The LHV used in applying this rule should be that of the entire (co-)product, not of only the dry fraction of it.

No emissions should be allocated to waste, agricultural crop residues and processing residues, since they are considered to have zero emissions until the point of their collection[19].

[19] Similarly, if these materials are used as raw materials, they start with zero emissions at the collection point.

Allocation should be applied directly after a co-product (a substance that would normally be storable or tradable) and biofuel/bioliquid/biomass fuel/intermediate product are produced at a process step. This can be a process step within a plant after which further "downstream" processing takes place for either product. However, if downstream processing of the (co-) products concerned is interlinked (by material or energy feedback loops) with any upstream part of the processing, the system is considered a "refinery"[20] and allocation is applied at the points where each product has no further downstream processing that is interlinked by material or energy feedback loops with any upstream part of the processing.

The energy content of co-products with negative energy content is set to zero.

3.11 Calculating the greenhouse gas emission saving by the last interface

The last interface calculates the total GHG emissions "E" in gCO_2eq/MJ of fuel (biofuel/bioliquid/biomass fuels). If actual values are applied, see section 2.3 "Calculation using actual values".

Greenhouse gas emissions, which are available in the unit gCO_2eq/t of dry feedstock, can be converted into the unit gCO_2eq/MJ of fuel using the following formula:

$$e_{ec}\text{fuel}_a\left[\frac{\text{g } CO_2\text{eq}}{MJ_{\text{fuel}}}\right]_{ec} = \frac{e_{ec}\text{feedstock}_a\left[\frac{gCO_2eq}{t_{dry}}\right]}{\text{LHV}_a\left[\frac{\text{MJ}_{\text{feedstock}}}{t_{\text{dry}}}\right]} \times fuel\ feedstock\ factor_a \times fuel\ allocation\ factor_a$$

The GHG emission saving of the supplied fuel is then calculated compared to the respective reference value for fossil fuels/liquids.

The GHG reduction potential of biofuels and biomass fuels for transport are calculated using the following formula:

$$\text{GHG emission savings} = (E_{F(t)} - E_B) / E_{F(t)}$$

[20] See Communication of the EU Commission (2010/C 160/02), Annex II

where:

EB = total emissions from the use of the biofuel/biomass fuel

$E_{F(t)}$ = total emissions from the fossil fuel comparator for transport

The fossil fuel comparator ($E_{F(t)}$) shall be 94 gCO_2eq/MJ of biofuel/biomass biofuel.

If the fossil fuel comparators change, the revised values will be implemented in the scheme with immediate effect.

The greenhouse gas saving from the use of bioliquids to produce heat and electricity and/or cooling or excess useful heat and electricity compared to the respective fossil reference value can be calculated using the following formula:

$$\text{GHG emission saving} = (EC_{F(h\&c,\ el)} - EC_{B(h\&c,\ el)}) / EC_{F(h\&c,el)}$$

where:

$EC_{B(h\&c,el)}$ = total emissions from the heat or electricity production

$EC_{F(h\&c,el)}$ = total emissions from the fossil fuel comparator for useful heat or electricity

For bioliquids used to produce electricity or excess useful heat and electricity, the fossil fuel comparator ($EC_{F(el)}$) is 183 gCO_2eq/MJ of electricity.

For bioliquids used to produce useful heat or to produce heat or cooling or excess useful heat and electricity, the fossil fuel comparator ($EC_{F(el)}$) is 80 gCO_2eq/MJ of heat.

If the fossil fuel comparators change, the revised values will be implemented in the scheme with immediate effect.

Greenhouse gas emissions from biomass installations that deliver only heat or excess useful heat are to be calculated as follows:

$$EC_h = \frac{E}{\eta_h}$$

Greenhouse gas emissions from biomass plants that deliver only electricity or excess electricity are to be calculated as follows:

$$EC_{el} = \frac{E}{\eta_{el}}$$

where:

$EC_{h,el}$ = total greenhouse gas emissions from the final energy commodity

E = total greenhouse gas emissions of the bioliquid before end conversion or the total greenhouse gas emissions of biofuel/bioliquid/biomass fuel used to produce the excess useful heat and electricity

η_{el} = the electrical efficiency, defined as the annual electricity produced divided by the annual fuel input, based on its energy content

η_h = the heat efficiency, defined as the annual useful heat output divided by the annual fuel input, based on its energy content

When heating and cooling are co-generated with electricity in a single process, emissions are allocated between useful heat and generated electricity. For the purposes of that calculation, the actual efficiencies shall be used, defined as the annual mechanical energy, electricity and heat produced respectively divided by the annual energy input.

GHG emissions for electricity or mechanical energy are calculated as follows:

$$EC_{el} = \frac{E}{\eta_{el}} \left(\frac{C_{el} - \eta_{el}}{C_{el} - \eta_{el} + C_h - \eta_h} \right)$$

The GHG emissions of useful heat produced in co-generation are calculated as follows:

$$EC_h = \frac{E}{\eta_h} \left(\frac{C_h - \eta_h}{C_{el} - \eta_{el} + C_h - \eta_h} \right)$$

where:

$EC_{h,el}$ = total greenhouse gas emissions from the final energy commodity

E = total greenhouse gas emissions of the bioliquid before end conversion

η_{el} = the electrical efficiency, defined as the annual electricity produced divided by the annual energy input, based on its energy content

η_h = the heat efficiency, defined as the annual useful heat output divided by the annual energy input, based on its energy content

C_{el} = fraction of exergy in the electricity, and/or mechanical energy, set to 100% (Cel = 1)

C_h = Carnot efficiency (fraction of exergy in the useful heat)

Exergy is the fraction of the total energy of a system or material flow that can do work when it is brought into thermodynamic equilibrium with its environment. In the case of the generation of electricity or mechanical energy, the REDcert scheme assumes that the exergy share is 100%, i.e. that there is no energy loss during the transmission through the grid until electricity is removed from the grid.

The useful part of the heat is found by multiplying its energy content with the Carnot efficiency (C_h). The Carnot efficiency (C_h) is the highest theoretically possible efficiency in converting thermal energy into useful heat. It describes the ratio of useful heat to the amount of heat absorbed and is higher the greater the temperature difference between the useful heat at the point of delivery and its ambient temperature. Since neither absolute zero nor infinitely high temperatures can be reached, a Carnot efficiency of 100% is impossible.

Accordingly, the Carnot efficiency (C_h) for useful heat is defined as follows:

$$C_h = \frac{T_h - T_0}{T_h}$$

where:

T_h = temperature, measured in absolute temperature (kelvin) of the useful heat at point of delivery

T_0 = temperature of surroundings, set at 273.15 kelvin (0°C)

If excess heat is generated in the cogeneration process and used to heat buildings, at a temperature below 150°C, C_h (423,15 kelvin) can be set at 0,3546.

For the purposes of that calculation, the following definitions apply:

(a) 'cogeneration' shall mean the simultaneous generation in one process of thermal energy and electrical and/or mechanical energy;

(b) 'useful heat' shall mean heat generated to satisfy an economical justifiable demand for heat, for heating or cooling purposes;

(c) 'economically justifiable demand' shall mean the demand that does not exceed the needs for heat or cooling and which would otherwise be satisfied at market conditions.

For information on calculating GHG emissions of biogas by co-digestion of different substrates, see section 3.12 "Calculation of biogas co-digestion processing emissions".

3.12 Calculation of biogas co-digestion processing emissions

GHG emissions may only be balanced in the case of the production of biogas for the production of biomethane. GHG emissions resulting from processes that deviate from this may only be balanced if the GHG values to be balanced are identical.

Balancing individual substrate-specific GHG emission values, in the case of the production of biogas for the production of biomethane, can be carried out both for default values and for actual values.

Balancing default values

Default values are balanced using the following formula:

$$E = \sum_{1}^{n} S_n \times E_n$$

where:

E = greenhouse gas emissions per MJ biomethane produced from co-digestion of the defined mixture of substrates

S_n = Share of feedstock n in energy content

E_n = emissions in g CO_2eq/MJ biomethane for the option as provided in Annex VI Part D of Directive (EU) 2018/2001

The share of feedstock n in the energy content is calculated as follows:

$$S_n = \frac{P_n \times W_n}{\sum_1^n P_n \times W_n}$$

where:

P_n = energy yield [MJ] per kilogram of wet input of feedstock n (*)

W_n = weighting factor of substrate n defined as:

$$W_n = \frac{I_n}{\sum_1^n I_n} \times \left(\frac{1 - AM_n}{1 - SM_n}\right)$$

where:

I_n = annual input to digester of substrate n [ton of fresh matter]

AM_n = average annual moisture of substrate n [kg water/kg fresh matter]

SM_n = standard moisture for substrate n (**)

(*) The following values for P_n are used to calculate typical and default values:

$P_{(Maize)}$ = 4,16 [MJ biogas/kg wet maize at 65% moisture]

$P_{(Manure)}$ = 0,50 [MJ biogas/kg wet manure at 90% moisture]

$P_{(Biowaste)}$ = 3,41 [MJ biogas/kg wet biowaste at 76% moisture]

(**) The following values of the standard moisture for substrate SM_n are used:

$SM_{(Maize)}$ = 0,65 [kg water/kg fresh matter]

$SM_{(Manure)}$ = 0.90 [kg water/kg fresh matter]

$SM_{(Biowaste)}$ = 0,76 [kg water/kg fresh matter]

Changes to these values or calculation methods originating from EU Directive (EU) 2018/2001, for example due to delegated acts of the EU Commission to review and, if necessary, adjust the methods and values of Annex VI of EU Directive (EU) 2018/2001, will take effect immediately in the REDcert scheme.

Balancing actual values:

The actual emissions of the biomethane can be balanced using the following formula:

$$E = \sum_1^n S_n \times (e_{ec,n} + e_{td,\ feedstock,n} + e_{l,n} - e_{sca,n}\ ) + e_p + e_{td\ ,product} + e_u - e_{ccs} - e_{ccr}$$

where:

E = greenhouse gas emissions from the production of biomethane before conversion into electricity

S_n = share of feedstock n, in fraction of input to the digester

$e_{ec,n}$ = emissions from the extraction or cultivation of feedstock n

$e_{td,feedstock,n}$ = emissions from transport of feedstock n to the digester

$e_{l,n}$ = annualised emissions from carbon stock changes caused by land-use change, for feedstock n

e_{sca} = emission savings from improved agricultural management of feedstock n

e_{p} = emissions from processing

$e_{td,Product}$ = emissions from transport and distribution of biogas and/or biomethane

e_{u} = emissions from the fuel in use, that is greenhouse gases emitted during combustion

e_{ccs} = emission savings from CO_2 capture and geological storage

e_{ccr} = emission savings from CO_2 capture and replacement

4 Liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels

In order to achieve the required minimum share of renewable energy in final energy consumption, member states may also take into account liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels.

Liquid or gaseous renewable fuels for transport of non-biogenic origin are liquid or gaseous fuels used in the transport sector, with the exception of biofuels or biogas, whose energy content comes from renewable energy sources other than biomass. This definition covers, for example, synthetically produced fuels produced by means of electrolysis of renewable electricity.

The greenhouse gas savings from the use of these fuels will be at least 70% with effect from 1 January 2021.

Recycled carbon fuels are liquid and gaseous fuels produced from liquid or solid waste flows of non-renewable origin which are not suitable for recycling pursuant to Article 4 of Directive 2008/98/EC[21], as well as from gas from waste processing and waste gas of non-renewable origin which are inevitably and unintentionally produced as a result of production

[21] DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL (https://eur-lex.europa.eu/legal-content/DE/ALL/?uri=CELEX:32008L0098)

processes in industrial installations. This definition includes, for example, collected flue gases which are then used for the production of biofuels.

The greenhouse gas savings resulting from the use of these fuels will be published by the Commission, by way of delegated act, by 1 January 2021.

In addition, the Commission will publish a methodology for assessing greenhouse gas savings from the use of liquid or gaseous renewable fuels for transport of non-biogenic origin and recycled carbon fuels by 31 December 2021. This method ensures that prevented emissions are not credited where capture of this CO_2 has already been credited under other legislation. Once this methodology has been adopted, the defined criteria apply with immediate effect in the REDcert scheme.

5 Relevant documents

The documentation structure of the REDcert-EU scheme includes the following:

No.	Document	Published/revised
1	Scope and basic scheme requirements	The current version of the REDcert-EU scheme principles is published on the website at www.redcert.org.
2	Scheme principles for the production of biomass, biofuels, biolquids and biomass fuels	
3	Scheme principles for GHG calculation	
4	Scheme principles for mass balance	
5	Scheme principles for neutral inspections	
6	Scheme principles integrity management	
7	Phase-specific checklists	

REDcert reserves the right to create and publish additional supplementary scheme principles if necessary.

The legal EU regulations and provisions for sustainable biomass as well as biofuels and bioliquids including other relevant references that represent the basis of the REDcert-EU documentation are published separately on the REDcert website at www.redcert.org. When legal regulations are referenced, the most current version is always assumed.

6 Revision information Version EU 05

Section	Change
Whole document	Reference **Adaption to:** Latest Directive "bioliquids/biofuels" and "biofuels and bioliquids" **Changed to:** "biofuels, bioliquids, or biomass fuels" respectively "biofuels/bioliquids/biomass fuels" "Inspector" **Changed to:** "Auditor" "feedstock factor" and "biofuel feedstock factor" **Changed to:** "feedstock factor intermediate product" respectively "fuel feedstock factor" **Deleted:** "eee" For raw materials and intermediate products unit g CO2eq/dry kilogram **Changed to:** g CO2eq/dry ton **Adapted:** Formulas
1	**Amended:** Whole Section

2.1	**Added:** […] "Any updates of these regulations or additional guidance by the European Commission on specific technical aspects regarding the calculation rules will immediately enter into force in the REDcert scheme." […] […] „E = eec + el + ep + etd + eu – esca – eccs – eccr – eee" […] **Changed to:** […] „E = eec + el + ep + etd + eu – esca – eccs – eccr" […] […] "eu = emissions from the use of the bioliquid/biofuel. Combustion or degradation of the biomass is not taken into account" […] **Changed to:** […]"eu emissions from the use of the biofuel/bioliquid/biomass fuel." […] **Deleted:** […] "eee = emissions savings from excess electricity from cogeneration" […] […] "Greenhouse gas emissions from raw materials and intermediate products are expressed in terms of grams of CO2 equivalent per kilogram of dry feedstock and intermediate products [gCO2eq/kg dry]." […] **Changed to:** […] "Greenhouse gas emissions from raw materials and intermediate products are expressed in terms of grams of CO2 equivalent per tonne of dry feedstock and intermediate prod-ucts [gCO2eq/t dry]." […] **Deleted:** […] "Emissions from fuel use (eu) are assumed to be 0 for biofuels and bioliquids." […] **Added:** […] "CO2 Emissions of the fuel in use (eu) shall be taken to be zero for biofuels, bioliquids and biomass fuels. Emissions of non-CO2 greenhouse gases (N2O and CH4) of the fuel in use shall be included in the eu factor

	for bioliquids and biomass fuels (excluding biomethane for transport).” […] […] “If these emissions deviate significantly from typical values […]” **Changed to:** […] “If these emissions deviate significantly (≥ 10%) from typical values […]” **Added:** “using a combination of disaggregated and actual values” […] **Restructured:** […] “For every phase in the production and supply chain, the use of (disaggregated) default values […] for the final biofuel/bioliquid/biomass fuel when reporting to the member states. If actual values are not used, the quantity of GHG emissions should not be transferred between various interfaces in the production chain because it is not possible to know whether this is a default value or an actual value in downstream phases. It is therefore the responsibility of downstream operators to include information about the (disaggre-gated) default GHG emission values for the final biofuel/bioliquid/biomass fuel when re-porting to the member states.”
2.2	**Renumbered/Renamed/Restructured** […] “Default values are to be taken from Annex V of Directive 2009/28/EC.” […] **Changed to:** […] “Default values are to be taken from Annex V, Part A and B and Annex VI, Part A and D of Directive (EU) 2018/2001 as well as from the RED II Corrigenda of 25. September 2020.” […] […] “When the total default value is used, […] if actual values have been applied” **Changed to:** […] “If a default value is to be used, it is determined by the last interface. In this case, it is sufficient for the upstream economic operators to simply indicate “use default value” or similar wording to the downstream economic operator. “ […]

	Added: […] "Where biomethane is used as compressed biomethane as a transport fuel, a value of 4.6 gCO2eq/MJ biomethane needs to be added to the default values included in Annex VI."
2.3	**Renumbered/Renamed/Restructured** **Added:** […] "GHG emissions shall be reported using the following units: a) g CO2eq/dry ton for raw materials and intermediatery products b) g CO2eq/MJ for final biofuels/bioliquids/biomass fuels The greenhouse gases to be included in the GHG calculation are CO2, N2O and CH4. To calculate the CO2 equivalence, these gases are weighted as follows in accordance with Directive (EU) 2018/2001 (as of 10/2020): Greenhouse gas CO2 equivalence CO2 1 N2O 298 CH4 25 If these values change in Directive (EU) 2018/2001, they apply in the REDcert scheme with immediate effect." […] **Deleted:** […] "For the purposes of allocation only, the "wet definition LHV" is used." […] […] "Inputs with little or no effects are those that have an impact of less than 0.5% on the total emissions of the respective production unit." […] **Changed to:** […] "Inputs with little or no effects are those that have a calculated impact of less than 0.5% on the total emissions of the respective production unit. " […] […] "The values (emission factors, heating values, etc.) published on the European Commission website should be used to calculate the actual GHGs:

	https://ec.europa.eu/energy/sites/ener/files/documents/Standard%20values%20v.1.0.xlsx. If alternative values are used, appropriate reasons must be provided and clearly indicated in the economic operator's documentation to facilitate verification by the inspector. "[…] **Changed to:** […] "The values (emission factors, heating values, etc.) published on the European Commis-sion website/ included in the Implementing Act shall be used to calculate the actual GHGs. However, whenever an item appears in the list, the use of alternative values must be duly justified. If alternative values are used, this must be indicated in the documentation of the calculations in order to facilitate the verification by the auditors. "[…]
2.4	**Renumbered/Renamed/Restructured** "Directive 2009/28/EC also provides disaggregated default values in accordance with sections A and D of Annex Vwhich relate to a part of production and can be used in combination with actual values to calculate the GHG emissions. The disaggregated default values may then also be used if the main production took place in a region which is listed in the reports of the member states as a NUTS level 2 region in the Common classification of territorial units for statistics" (NUTS) or a region at a more disaggregated NUTS level, and in which the GHG emissions from cultivation correspond to the disaggregated default value stipulated in Annex V, Part D of Directive 2009/28/EC.NUTS-2 values are to be indicated in the unit gCO2eq/kgdry along the entire production chain. These values are alternatives to the individually calculated values. They are published on the website of the European Commission and are not default values. Consequently, they can only be considered input values to calculate individual values of the downstream interfaces. They are not, however, suitable for specifying emissions from cultivation in gCO2eq/MJ ofbiofuel/bioliquid." […] **Changed to:** "Directive (EU) 2018/2001 also provides disaggregated default values in accordance with Part D and E of Annex V and Part C of Annex VI as well as the RED II Corrigenda of 25. September 2020 , which relate to part of production and can be used in combination with actual values to calculate the GHG emissions. If the main production took place in a region which is listed in the reports of the member states as a NUTS level 2 region or a region at a more disaggregated NUTS level , economic operators can apply these specific data as an alternative to disaggregated default

	values, provided the data has been approved by the European Commission.” […] […] “Disaggregated default values are to be taken from Annex V of Directive 2009/28/EC.” […] **Changed to:** […] “Disaggregated default values are to be taken from Annex V and VI of Directive (EU) 2018/2001 and can only be applied if the process technology and feedstock used for the production of the biofuel/bioliquid/biomass fuel match their description and scope. ” […] **Added:** […] “The disaggregated default values should only be reported for final […] if actual values have been applied.” […]
3.1	**Renumbered/Renamed/Restructured** “[…] specified in mass units in relation to the dry harvest yield or dry main product (kgCO2eq/kg dry). The harvest yield relates to the dry matter content.” […] **Changed to:** […] “The GHG emissions from raw material production are specified in relation to the dry harvest yield or dry main product (gCO2eq/t dry).” […] […] “The values (emission factors, heating values, etc.) published on the European Commission website should be used to calculate eec:” […] **Changed to:** […] “The values (emission factors, heating values, etc.) published on the European Commis-sion website should shall be used to calculate eec:” […] **Added:** […] “However, whenever an item is covered by the list, the use of alternative values must be duly justified. In case alternative values are chosen, this must be flagged up in the documentation of the calculations in order to facilitate the verification by auditors. ” […]

	[…] "The life cycle greenhouse gas emissions from waste, agricultural crop residues and production residues, including crude glycerine (unrefined glycerine), from the production of biofuels and bioliquids are considered to have zero emissions until the point of their collection. " **Changed to:** […] "Life cycle greenhouse gas emissions from waste and residues, including straw, husks, corn cobs and nutshells, and residues from processing, including crude glycerine (unre-fined glycerine) and bagasse, are set to zero until these materials are collected, regard-less of whether they are processed into intermediate products before being converted into the final product . Materials can be classified as waste, residue or a co-product us-ing the European Commission Communication COM(2007) 59 and/or on the basis of the REDcert scheme principles for the production of biomass, biofuels, bioliquids and biomass fuels. "
3.2	**Renumbered/Renamed/Restructured** "Land use change taking place after […] not considered land-use change." […] **Changed to:** "In the case of land-use changes […] not considered land-use change." […] **Deleted/Restructured:** […] "The Commission Decision provides details on the calculation of emissions from changes in carbon stock resulting from land-use change (http://eur-lex.europa.eu/legal-content/DE/TXT/PDF/?uri=CELEX:32010D0335&from=DE)." […] […] "eB = bonus of 29 gCO2eq/MJ biofuel if biomass is obtained from restored degraded land under the conditions provided for in point 8 The bonus for the use of degraded/restored land (eB) cannot be applied until the Commission has provided definitions." […] **Changed to:** eB = Bonus of 29 gCO2eq/MJ of biofuel, bioliquids or biomass fuel if the biomass is produced on restored degraded land under the following conditions: If evidence is provided that the land:

	(a) was not in use for agriculture or any other activity in January 2008; and (b) is severely degraded land, including such land that was formerly in agricul-tural use. The bonus of 29 gCO2eq/MJ shall apply for a period of up to 20 years from the date of conversion of the land to agricultural use, provided that a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (b) are ensured."[…] **Added:** […] "Severely degraded land" means land that, for a significant period of time, has either been significantly salinated or presented significantly low organic matter content and has been severely eroded." […] **Added:** […] "The Commission shall review, by 31 December 2020, […] The criteria defined in the guideline apply with immediate effect in the REDcert scheme." […] **Deleted** […] "For converted land where cultivation is permitted pursuant to Article 17 of Directive 2009/28/EC, […] The land-use category the cultivated land falls into as of 1 January 2008 therefore has to be determined." […]
3.4	"According to the communication from the Commission on the practical implementation […] over the period in which the raw materials concerned were cultivated." […] **Changed to:** "Improved agricultural management practices, such as the following: […] increased use of fertilisers and plant protection products associated with these practices." […] **Added:** […] "Similarly, the use of manure as a substrate for the production of biogas and biomethane is regarded as improved agricultural manure management, which contributes to emission reduction by preventing diffuse field emissions and can therefore be counted towards esca in

	accordance with Directive (EU) 2018/2001, Annex VI, Part B, No. 1 with a credit of 45 gCO2eq/MJ manure or 54 kg CO2eq/t of fresh matter.” […] […] “eB = bonus of 29 gCO2eq/MJ biofuel if biomass is obtained from restored degraded land under the conditions provided for in point 8 The bonus for the use of degraded/restored land (eB) cannot be applied until the Commission has provided definitions.” […] **Changed to:** eB = Bonus of 29 gCO2eq/MJ of biofuel, bioliquids or biomass fuel if the biomass is produced on restored degraded land under the following conditions: If evidence is provided that the land: (a) was not in use for agriculture or any other activity in January 2008; and (b) is severely degraded land, including such land that was formerly in agricul-tural use. The bonus of 29 gCO2eq/MJ shall apply for a period of up to 20 years from the date of conversion of the land to agricultural use, provided that a steady increase in carbon stocks as well as a sizable reduction in erosion phenomena for land falling under (b) are ensured.”[…]
3.5	**Renumbered/Renamed/Restructured** “Emissions from transport and distribution/supply […] emissions from filling stations.” […] **Changed to:** “Emissions from transport and distribution (etd) […] are also taken into account in this formula.” […] **Added:** […] “This formula applies analogously to all transport options and the energy consumed for them. ” […] […] “The values (emission factors, fuel consumption, etc.) published on the European Commis-sion website should be used to calculate etd.” […] **Changed to:** […] “The values (emission factors, fuel consumption, etc.) published on the European Commis-sion website shall be used to calculate etd.” […]

	Added: […] "However, whenever an item appears in the list, the use of alternative values must be duly justified. If alternative values are used, this must be indicated in the documentation of the calculations in order to facilitate the verification by the auditors." […] **Deleted:** […] "The last interface must determine these emissions up to the place of final use and specify which countries and regions the product (bioliquid/biofuel) can be transported to without falling short of the minimum GHG emission saving." […] […] "Figures for GHG emissions at depots and filling stations are published by BioGrace at: http://www.biograce.net/home. The European Commission (EC) provided additional background information on depot and filling station emissions to the EU voluntary schemes in a document entitled "Note on emissions from filling stations and depots". This document serves as a guide (see Annex 1)." **Changed to:** […] "For the calculation of the emissions produced by filling stations and depots, the values published by JRC[15] (Storage: 0.00084 MJ/MJ fuel, filling station: 0.0034 MJ/MJ fuel) can be applied. Please note that these values need to be multiplied with the latest EU electricity grid factor to get the final emissions of the storage or the filling station (e.g. Storage emissions= 0.00084 MJ/MJ fuel x $EF_{electicity}$. These values are applicable for all biofuels (e.g. FAME, Ethanol). The values, however, are not applicable for biomethane for transport sector because they do not include the compression at the filling station."
3.6	**New secion**
3.7	**Renumbered/Renamed/Restructured** "Every processing facility must ensure […] production of chemicals or products used in processing." […] **Changed to:** "Emissions from processing (ep) […] whether they are actually combusted in the process. […]

	[…] "To calculate the GHG emissions from processing (ep), the following data at a minimum must be collected on site, i.e. the respective values are taken from, e.g. company documents: ☐ electricity consumption [kWh/yr] – total externally procured electricity consumption per year (i.e. not produced in one's own combined heat and power (CHP) plant)" […] **Changed to:** […] "To calculate the GHG emissions from processing (ep), the following data at a minimum must be collected on site, i.e. the respective values are taken from, e.g. company docu-ments: ☐ electricity consumption [kWh/yr] – total electricity consumption per year" […] **Deleted:** […] "In the case of conventional methanol in the original RED calculations, 0.0585 MJ of methanol was used per MJ of FAME produced, with an emissions factor of 99.57 g CO2eq per MJ of methanol. This factor is included along with those for other inputs in the list of standard values published on the Commission's website. " […] […] "The values (emission factors, heating values, etc.) published on the European Commission website should be used to calculate ep: https://ec.europa.eu/energy/sites/ener/files/documents/Standard%20values%20v.1.0.xlsx" […] **Changed to:** […] "The values (emission factors, heating values, etc.) published on the European Commis-sion website shall be used to calculate ep: https://ec.europa.eu/energy/topics/renewable-energy/biofuels/voluntary-schemes_en?redir=1" […] **Added:** […] "However, whenever an item is covered by the list, the use of alternative values must be duly justified. In case alternative values are chosen, this must be flagged up in the documentation of the calculations in order to facilitate the verification by auditors." […]
3.7	**Renumbered/Renamed/Restructured**

	[…] "In accounting for the consumption of electricity not produced within the conversion plant, […] for the type of renewable electricity may be set to zero." […] **Changed to:** […] "In accounting for the consumption of electricity not produced within the biofuel plant, […] the emission factor for electricity or heat can be set to 0." **Deleted:** […] "Emission saving from excess electricity from combined heat and power plants (eee) […] or scientifically recognised database (e.g. BioGrace, ecoinvent database) can be used:" […]
3.8	**Renumbered/Renamed/Restructured** […] "Emission saving from carbon capture and replacement (eccr) shall be limited to emissions avoided through the capture of CO2 which the carbon originates from biomass and which is used to replace fossil-derived carbon dioxide used in commercial products and services." […] **Changed to:** […] "Emission savings from CO2 capture and replacement, eccr, shall be related directly to the production of biomass fuel they are attributed to, and shall be limited to emissions avoided through the capture of CO2 of which the carbon originates from biomass and which is used to replace fossil-derived CO2 in production of commercial products and services." […] […] "The requirement "used to replace fossil-derived CO2" is assumed to be satisfied as long as it is common commercial practice to consume only CO2 with fossil origin for "commercial products and services." […] **Changed to:** […] "To be able to claim these emission savings, the following proof must be provided: […] can be expected to have an economical meaningful use for the CO2." […] […] "as well as the respective greenhouse gas emissions values for these consumed quantities." […] **Changed to:**

	[…] "This data, as well as further information on the greenhouse gas intensity of the sub-stances/energies used, is required to calculate the emission savings using the formula element eccr. " […] **Deleted:** […] "These GHG savings are, however, excluded from the allocation and are thus allocated 100% to the main product (in accordance with RED 2009/28 Annex V, C.17 & C.18 of Directive 2009/28/EC). " […]
3.9	**Renumbered/Renamed/Restructured** […] "The following are also to be determined in relation to the processing of CO2 (compression and liquefaction to carbon dioxide): ☐ consumed quantity of energy (electricity, heat, etc.) ☐ consumed quantity of auxiliary materials ☐ other process-specific, energy-related input variables are included here" […] **Changed to:** […] "The following are also to be determined in relation to the processing of CO2 (e.g. separa-tion and compression of CO2): ☐ consumed quantity of energy (electricity, heat, etc.) ☐ consumed quantity of auxiliary materials ☐ other process-specific, energy-related input variables This data, as well as further information on the greenhouse gas intensity of the sub-stances/energies used, is required to calculate the emission savings using the formula element eccs. " […] […] "The emission savings from carbon dioxide capture and geological storage (eccs) […] is in good condition and that leakages are non-existent. " […] **Changed to:** […] "Emission savings from carbon capture and geological storage (eccs) […] with Directive 2009/31/EC on the geological storage of carbon dioxide. " […] **Deleted:**

	[…] "These GHG savings are, however, excluded from the allocation and are thus allocated 100% to the main product (in accordance with RED 2009/28 Annex V, C.17 & C.18 of Directive 2009/28/EC). " […]
3.10	**Renumbered/Renamed/Restructured** […] "Allocation takes place in every process step that the main product passes through in which a co-product is produced. All GHG emissions up to this process step are to be distributed to the main and co-product proportional to their energy content." […] **Changed to:** […] "If other products ("co-products") are produced during a fuel production process in addi-tion to the fuel, the total greenhouse gas emissions from the process are allocated be-tween the biofuel/bioliquid/biomass fuel or intermediate product and the co-products according to their energy content (lower heating value)." […] […] "For the purposes of the calculation, the emissions to be divided shall be eec + el + those fractions of ep, etd and eee that occur up to and including the process step at which a co-product is produced." […] **Changed to:** […] "The allocation involves the formula elements eec + el + esca + the shares of ep, etd, eccs and eccr up to and including the process step where a co-product is produced." […] **Added:** […] "Heat and electricity are generally excluded from allocation. […] The detailed calculation method to calculate the greenhouse gas intensity of excess use-ful heat and electricity is described in section 3.11 "Calculating the greenhouse gas emis-sion saving by the last interface". " […] **Deleted:** […] "Because heat does not have a lower heating value, no emissions can be allocated to it on this basis. " […] **Deleted:** […] "The allocation rule does not apply to electricity […] of the calculation is the refinery." […]

3.11	**Whole Section**
3.12	**Whole Section**
4	**New Section**
5	**Whole Section**
Annex 1	**Deleted**